Osteoporosis Overview

Osteoporosis, or porous bone, is a disease characterized by low bone mass and structural deterioration of bone tissue, leading to bone fragility and an increased risk of fractures of the hip, spine, and wrist. Men as well as women are affected by osteoporosis, a disease that can be prevented and treated.

Facts and Figures

- Osteoporosis is a major public health threat for 44 million Americans, 68 percent of whom are women.
- In the U.S. today, 10 million individuals already have osteoporosis and 34 million more have low bone mass, placing them at increased risk for this disease.
- One out of every two women and one in four men over 50 will have an osteoporosis-related fracture in their lifetime.
- More than 2 million American men suffer from osteoporosis, and millions more are at risk. Each year, 80,000 men have a hip fracture and one-third of these men die within a year.
- Osteoporosis can strike at any age.
- Osteoporosis is responsible for more than 1.5 million fractures annually, including 300,000 hip fractures, approximately 700,000 vertebral fractures, 250,000 wrist fractures, and more than 300,000 fractures at other sites.
- Based on figures from hospitals and nursing homes, the estimated national direct expenditures for osteoporosis and related fractures total $14 billion each year.

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The National Institutes of Health (NIH) is a component of the U.S. Department of Health and Human Services.

What Is Bone?

Bone is living, growing tissue. It is made mostly of collagen, a protein that provides a soft framework, and calcium phosphate, a mineral that adds strength and hardens the framework.

This combination of collagen and calcium makes bone both flexible and strong, which in turn helps it to withstand stress. More than 99 percent of the body's calcium is contained in the bones and teeth. The remaining 1 percent is found in the blood.

Throughout your lifetime, old bone is removed (resorption) and new bone is added to the skeleton (formation). During childhood and teenage years, new bone is added faster than old bone is removed. As a result, bones become larger, heavier, and denser. Bone formation outpaces resorption until peak bone mass (maximum bone density and strength) is reached around age 30. After that time, bone resorption slowly begins to exceed bone formation.

For women, bone loss is fastest in the first few years after menopause, and it continues into the postmenopausal years. Osteoporosis – which mainly affects women but may also affect men – will develop when bone resorption occurs too quickly or when replacement occurs too slowly. Osteoporosis is more likely to develop if you did not reach optimal peak bone mass during your bone-building years.

Risk Factors

Certain risk factors are linked to the development of osteoporosis and contribute to an individual's likelihood of developing the disease. Many people with osteoporosis have several risk factors, but others who develop the disease have no known risk factors. There are some you cannot change and others you can.

Risk factors you cannot change:

- *Gender* – Your chances of developing osteoporosis are greater if you are a woman. Women have less bone tissue and lose bone faster than men because of the changes that happen with menopause.
- *Age* – The older you are, the greater your risk of osteoporosis. Your bones become thinner and weaker as you age.
- *Body size* – Small, thin-boned women are at greater risk.
- *Ethnicity* – Caucasian and Asian women are at highest risk. African American and Hispanic women have a lower but significant risk.

- *Family history* – Fracture risk may be due, in part, to heredity. People whose parents have a history of fractures also seem to have reduced bone mass and may be at risk for fractures.

Risk factors you can change:

- *Sex hormones* – Abnormal absence of menstrual periods (amenorrhea), low estrogen level (menopause), and low testosterone level in men can bring on osteoporosis.
- *Anorexia nervosa* – Characterized by an irrational fear of weight gain, this eating disorder increases your risk for osteoporosis.
- *Calcium and vitamin D intake* – A lifetime diet low in calcium and vitamin D makes you more prone to bone loss.
- *Medication use* – Long-term use of glucocorticoids and some anticonvulsants can lead to loss of bone density and fractures.
- *Lifestyle* – An inactive lifestyle or extended bed rest tends to weaken bones.
- *Cigarette smoking* – Cigarettes are bad for bones as well as the heart and lungs.
- *Alcohol intake* – Excessive consumption increases the risk of bone loss and fractures.

Prevention

To reach optimal peak bone mass and continue building new bone tissue as you age, there are several factors you should consider.

Calcium: An inadequate supply of calcium over a lifetime contributes to the development of osteoporosis. Many published studies show that low calcium intake appears to be associated with low bone mass, rapid bone loss, and high fracture rates. National nutrition surveys show that many people consume less than half the amount of calcium recommended to build and maintain healthy bones. Good sources of calcium include low-fat dairy products, such as milk, yogurt, cheese, and ice cream; dark green, leafy vegetables, such as broccoli, collard greens, bok choy, and spinach; sardines and salmon with bones; tofu; almonds; and foods fortified with calcium, such as orange juice, cereals, and breads. Depending upon how much calcium you get each day from food, you may need to take a calcium supplement.

Calcium needs change during one's lifetime. The body's demand for calcium is greater during childhood and adolescence, when the skeleton is growing rapidly, and during pregnancy and breastfeeding. Postmenopausal women and older men also need to consume more calcium. Also, as you age, your body becomes less

efficient at absorbing calcium and other nutrients. Older adults also are more likely to have chronic medical problems and to use medications that may impair calcium absorption.

Recommended Calcium Intakes (mg/day)
National Academy of Sciences (1997)

Ages	
Birth-6 months	210
6 months-1 year	270
1-3	500
4-8	800
9-13	1300
14-18	1300
19-30	1000
31-50	1000
51-70	1200
70 or older	1200
Pregnant or lactating	
14-18	1300
19-50	1000

Vitamin D: Vitamin D plays an important role in calcium absorption and in bone health. It is made in the skin through exposure to sunlight. While many people are able to obtain enough vitamin D naturally, studies show that vitamin D production decreases in the elderly, in people who are housebound, and for people in general during the winter. Depending on your situation, you may need to take vitamin D supplements to ensure a daily intake of between 400 to 800 IU of vitamin D. Massive doses are not recommended.

Exercise: Like muscle, bone is living tissue that responds to exercise by becoming stronger. Weight-bearing exercise is the best for your bones because it forces you to work against gravity. Examples include walking, hiking, jogging, stair climbing, weight training, tennis, and dancing.

Smoking: Smoking is bad for your bones as well as for your heart and lungs. Women who smoke have lower levels of estrogen compared to nonsmokers, and they often go through menopause earlier. Smokers also may absorb less calcium from their diets.

Alcohol: Regular consumption of 2 to 3 ounces a day of alcohol may be damaging to the skeleton, even in young women and men. Those who drink heavily are more prone to bone loss and fractures, because of both poor nutrition and increased risk of falling.

Medications that cause bone loss: The long-term use of glucocorticoids (medications prescribed for a wide range of diseases, including arthritis, asthma, Crohn's disease, lupus, and other diseases of the lungs, kidneys, and liver) can lead to a loss of bone density and fractures. Bone loss can also result from long-term treatment with certain antiseizure drugs – such as phenytoin (Dilantin[1]) and barbiturates; gonadotropin-releasing hormone (GnRH) drugs used to treat endometriosis; excessive use of aluminum-containing antacids; certain cancer treatments; and excessive thyroid hormone. It is important to discuss the use of these drugs with your physician and not to stop or change your medication dose on your own.

Preventive medications: Various medications are available for preventing and treating osteoporosis. See section entitled "Therapeutic Medications."

Symptoms

Osteoporosis is often called the "silent disease" because bone loss occurs without symptoms. People may not know that they have osteoporosis until their bones become so weak that a sudden strain, bump, or fall causes a hip to fracture or a vertebra to collapse. Collapsed vertebrae may initially be felt or seen in the form of severe back pain, loss of height, or spinal deformities such as kyphosis (severely stooped posture).

Detection

Following a comprehensive medical assessment, your doctor may recommend that you have your bone mass measured. A bone mineral density (BMD) test is the best way to determine your bone health. BMD tests can identify osteoporosis, determine your risk for fractures (broken bones), and measure your response to osteoporosis treatment. The most widely recognized bone mineral density test is called a dual-energy x-ray absorptiometry or DXA test. It is painless – a bit like

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[1] Brand names included in this publication are provided as examples only, and their inclusion does not mean that these products are endorsed by the National Institutes of Health or any other Government agency. Also, if a particular brand name is not mentioned, this does not mean or imply that the product is unsatisfactory.

having an x ray, but with much less exposure to radiation. It can measure bone density at your hip and spine. Bone density tests can:

- Detect low bone density before a fracture occurs.
- Confirm a diagnosis of osteoporosis if you already have one or more fractures.
- Predict your chances of fracturing in the future.
- Determine your rate of bone loss, and/or monitor the effects of treatment if the test is conducted at intervals of a year or more.

Treatment

A comprehensive osteoporosis treatment program includes a focus on proper nutrition, exercise, and safety issues to prevent falls that may result in fractures. In addition, your physician may prescribe a medication to slow or stop bone loss, increase bone density, and reduce fracture risk.

Nutrition: The foods we eat contain a variety of vitamins, minerals, and other important nutrients that help keep our bodies healthy. All of these nutrients are needed in balanced proportion. In particular, calcium and vitamin D are needed for strong bones, and for your heart, muscles, and nerves to function properly. (See **Prevention** section for recommended amounts of calcium.)

Exercise: Exercise is an important component of an osteoporosis prevention and treatment program. Exercise not only improves your bone health, but it increases muscle strength, coordination, and balance, and leads to better overall health. While exercise is good for someone with osteoporosis, it should not put any sudden or excessive strain on your bones. As extra insurance against fractures, your doctor can recommend specific exercises to strengthen and support your back.

Therapeutic Medications: Currently, alendronate, raloxifene, risedronate, and ibandronate are approved by the U. S. Food and Drug Administration (FDA) for preventing and treating postmenopausal osteoporosis. Teriparatide is approved for treating the disease in postmenopausal women and men at high risk for fracture. Estrogen/hormone therapy (ET/HT) is approved for preventing postmenopausal osteoporosis, and calcitonin is approved for treatment. In addition, alendronate is approved for treating osteoporosis in men, and both alendronate and risedronate are approved for use by men and women with glucocorticoid-induced osteoporosis. Alendronate plus vitamin D is approved for the treatment of osteoporosis in postmenopausal women and in men. Risedronate with calcium is approved for the prevention and treatment of osteoporosis in postmenopausal women.

- *Bisphosphonates* – Alendronate (Fosamax), risedronate (Actonel), and ibandronate (Boniva) are medications from the class of drugs called bisphosphonates. Like estrogen and raloxifene, these bisphosphonates are approved for both prevention and treatment of postmenopausal osteoporosis. Alendronate is also approved to treat bone loss that results from glucocorticoid medications like prednisone or cortisone and is approved for treating osteoporosis in men. Risedronate is also approved to prevent and treat glucocorticoid-induced osteoporosis. Alendronate plus vitamin D is approved for the treatment of osteoporosis in postmenopausal women and in men. Risedronate with calcium is approved for the prevention and treatment of osteoporosis in postmenopausal women.

  Alendronate and risedronate have been shown to increase bone mass and reduce the incidence of spine, hip, and other fractures. Ibandronate has been shown to reduce the incidence of spine fractures.

  Alendronate is available in daily and weekly doses, while alendronate plus vitamin D is available in a weekly dose. Risedronate is available in daily and weekly doses, while risedronate with calcium is available in a weekly dose. Ibandronate is available in a monthly dose and as an intravenous injection administered once every three months.

  Oral bisphosphonates should be taken on an empty stomach and with a full glass of water first thing in the morning. It is important to remain in an upright position and refrain from eating or drinking for at least 30 minutes after taking a bisphosphonate.

  Side effects for bisphosphonates include gastrointestinal problems such as difficulty swallowing, inflammation of the esophagus, and gastric ulcer. There have been rare reports of osteonecrosis of the jaw and of visual disturbances in people taking bisphosphonates.

- *Raloxifene* – Raloxifene (Evista) is approved for the prevention and treatment of postmenopausal osteoporosis. It is from a class of drugs called Selective Estrogen Receptor Modulators (SERMs) that appear to prevent bone loss in the spine, hip, and total body. Raloxifene has beneficial effects on bone mass and bone turnover and can reduce the risk of vertebral fractures. While side effects are not common with raloxifene, those reported include hot flashes and blood clots in the veins, the latter of which is also associated with estrogen therapy. Additional research studies on raloxifene will continue for several more years.

- *Calcitonin* – Calcitonin is a naturally occurring hormone involved in calcium regulation and bone metabolism. In women who are at least 5 years past menopause, calcitonin slows bone loss, increases spinal bone density, and according to anecdotal reports, relieves the pain associated with bone fractures. Calcitonin reduces the risk of spinal fractures and may reduce hip fracture risk as well. Studies on fracture reduction are ongoing. Calcitonin is currently available as an injection or nasal spray. While it does not affect other organs or systems in the body, injectable calcitonin may cause an allergic reaction and unpleasant side effects including flushing of the face and hands, frequent urination, nausea, and skin rash. The only side effect reported with nasal calcitonin is a runny nose.

- *Teriparatide* – Teriparatide (Forteo) is an injectable form of human parathyroid hormone. It is approved for postmenopausal women and men with osteoporosis who are at high risk for having a fracture. Teriparatide stimulates new bone formation in both the spine and the hip. It also reduces the risk of vertebral and nonvertebral fractures in postmenopausal women. In men, teriparatide reduces the risk of vertebral fractures. However, it is not known whether teriparatide reduces the risk of nonvertebral fractures. Side effects include nausea, dizziness and leg cramps. Teriparatide is approved for use for up to 24 months.

- *Estrogen/Hormone Therapy* – Estrogen/hormone therapy (ET/HT) has been shown to reduce bone loss, increase bone density in both the spine and hip, and reduce the risk of hip and spine fractures in postmenopausal women. ET/HT is approved for preventing postmenopausal osteoporosis and is most commonly administered in the form of a pill or skin patch. When estrogen – also known as estrogen therapy or ET – is taken alone, it can increase a woman's risk of developing cancer of the uterine lining (endometrial cancer). To eliminate this risk, physicians prescribe the hormone progestin – also known as hormone therapy or HT – in combination with estrogen for those women who have not had a hysterectomy. Side effects of ET/HT include vaginal bleeding, breast tenderness, mood disturbances, blood clots in the veins, and gallbladder disease.

  The Women's Health Initiative, a large Government-funded research study, recently demonstrated that the drug Prempro, which is used in hormone therapy, is associated with a modest increase in the risk of breast cancer, stroke, and heart attack. The WHI also demonstrated that estrogen therapy is associated with an increase in the risk of stroke. It is unclear whether estrogen therapy is associated with an increased risk of breast cancer or cardiovascular events. A large study from the National Cancer Institute indicated that long-term use of estrogen therapy may be associated with an increased risk of ovarian cancer. It is unclear whether hormone therapy carries a similar risk.

Any estrogen therapy should be prescribed for the shortest period of time possible. When used solely for the prevention of postmenopausal osteoporosis, any ET/HT regimen should only be considered for women at significant risk of osteoporosis, and nonestrogen medications should be carefully considered first.

Fall Prevention

Preventing falls is a special concern for men and women with osteoporosis. Falls can increase the likelihood of fracturing a bone in the hip, wrist, spine, or other part of the skeleton. In addition to the environmental factors listed below, falls can also be caused by impaired vision and/or balance, chronic diseases that affect mental or physical functioning, and certain medications, such as sedatives and antidepressants. It is important that individuals with osteoporosis be aware of any physical changes that affect their balance or gait, and that they discuss these changes with their health care provider. Here are some tips to help eliminate the environmental factors that lead to falls.

Outdoors:

- Use a cane or walker for added stability.
- Wear rubber-soled shoes for traction.
- Walk on grass when sidewalks are slippery.
- In winter, carry salt or kitty litter to sprinkle on slippery sidewalks.
- Be careful on highly polished floors that become slick and dangerous when wet.
- Use plastic or carpet runners when possible.

Indoors:

- Keep rooms free of clutter, especially on floors.
- Keep floor surfaces smooth but not slippery.
- Wear supportive, low-heeled shoes even at home.
- Avoid walking in socks, stockings, or slippers.
- Be sure carpets and area rugs have skid-proof backing or are tacked to the floor.
- Be sure stairwells are well lit and that stairs have handrails on both sides.
- Install grab bars on bathroom walls near tub, shower, and toilet.
- Use a rubber bath mat in shower or tub.
- Keep a flashlight with fresh batteries beside your bed.
- If using a step stool for hard-to-reach areas, use a sturdy one with a handrail and wide steps.
- Add ceiling fixtures to rooms lit by lamps.
- Consider purchasing a cordless phone so that you don’t have to rush to answer the phone when it rings, or so that you can call for help if you do fall.

The National Resource Center acknowledges the assistance of the National Osteoporosis Foundation in the preparation of this publication.

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For Your Information

This publication contains information about medications used to treat the health condition discussed here. When this fact sheet was printed, we included the most up-to-date (accurate) information available. Occasionally, new information on medication is released.

For updates and for any questions about any medications you are taking, please contact the U.S. Food and Drug Administration at 1-888-INFO-FDA (1-888-463-6332, a toll-free call) or visit their Web site at www.fda.gov.

Bone Mass Measurement: What the Numbers Mean

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What Is a Bone Density Test?

A bone mineral density (BMD) test is the best way to determine your bone health. BMD tests can identify osteoporosis, determine your risk for fractures (broken bones), and measure your response to osteoporosis treatment. The most widely recognized bone mineral density test is called a dual-energy x-ray absorptiometry or DXA test. It is painless – a bit like having an x ray. It can measure bone density at your hip and spine.

What Does the Test Do?

A DXA test measures your bone mineral density and compares it to that of an established norm or standard in order to give you a score. Although no bone density test is 100 percent accurate, it is the single most important predictor of whether a person will have a fracture in the future.

T-score

Most commonly, your DXA test results are compared to the ideal or peak bone mineral density of a healthy 30-year-old adult, and you are given a T-score. A score of 0 means your BMD is equal to the norm for a healthy young adult. Differences between your BMD and that of the healthy young adult norm are measured in units called standard deviations (SDs). The more standard deviations below 0, indicated as negative numbers, the lower your BMD and the higher your risk of fracture.

As shown in the table below, a T-score between +1 and -1 is considered normal or healthy. A T-score between -1 and -2.5 indicates that you have low bone mass, although not low enough to be diagnosed with osteoporosis. A T-score of -2.5 or lower indicates that you have osteoporosis. The greater the negative number, the more severe the osteoporosis.

World Health Organization Definitions Based on Bone Density Levels	
Normal	Bone density is within 1 SD (+1 or -1) of the young adult mean.
Low Bone Mass	Bone density is between 1 and 2.5 SD below the young adult mean (-1 to -2.5 SD).
Osteoporosis	Bone density is 2.5 SD or more below the young adult mean (-2.5 SD or lower).
Severe (established) osteoporosis	Bone density is more than 2.5 SD below the young adult mean and there have been one or more osteoporotic fractures.

Z-score

Sometimes, your bone mineral density is compared to that of a typical individual whose age is matched to yours. This comparison gives you a Z-score. Because low BMD is common among older adults, comparisons with the BMD of a typical individual whose age is matched to yours can be misleading. Therefore, the diagnosis of osteoporosis or low bone mass is based on your T-score. However, a Z-score can be useful for determining whether there may be an underlying disease or condition that is causing bone loss.

Low Bone Mass Versus Osteoporosis

The information provided by a BMD test can help your doctor decide which prevention or treatment options are right for you.

If you have low bone mass that is not low enough to be diagnosed as osteoporosis, this is sometimes referred to as osteopenia. Low bone mass could be caused by many factors such as:

- heredity
- the development of less-than-optimal peak bone mass in your youth
- a medical condition or medication to treat such a condition that negatively affects bone
- abnormally accelerated bone loss.

While not everyone who has low bone mass will develop osteoporosis, everyone with low bone mass is at higher risk for the disease and the resulting fractures.

As a person with low bone mass, you can take steps to help slow down your bone loss and prevent osteoporosis in your future. Your doctor will want you to develop – or keep – healthy habits like eating foods rich in calcium and vitamin D, and doing weight-bearing exercise like walking, jogging, or dancing. In some cases, medication to prevent osteoporosis may be recommended.

Osteoporosis: If you are diagnosed with osteoporosis, these healthy habits will help, but your doctor will probably also recommend that you take medication. Several effective medications are available to slow – or even reverse – bone loss. If you do take medication to treat osteoporosis, your doctor can advise you concerning the need for future BMD tests to check your progress.

Who Should Get a Bone Density Test?

The United States Preventive Service Task Force recommends that women age 65 and older be screened routinely for osteoporosis. The task force also recommends that routine screening begin at age 60 for women who are at increased risk for osteoporotic fractures.

In addition, a panel convened by the National Institutes of Health in 2000 recommended that bone density testing be considered in people taking glucocorticoid medications for 2 months or more and in those with conditions that place them at high risk for an osteoporosis-related fracture.

However, the panel did not find enough scientific evidence upon which to base universal recommendations regarding when all women and men should obtain a bone density test. Instead, an individualized approach is recommended.

Also, various professional medical societies have established guidelines concerning when a person should get a bone density test. Many of these guidelines can be found by conducting a search in an online database established by the National Guideline Clearinghouse at www.guideline.gov.

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For Your Information

For updates and for any questions about any medications you are taking, please contact the U.S. Food and Drug Administration at 1-888-INFO-FDA (1-888-463-6332, a toll-free call) or visit their Web site at www.fda.gov.

Calcium and Vitamin D: Important at Every Age

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The National Institutes of Health (NIH) is a component of the U.S. Department of Health and Human Services.

The foods we eat contain a variety of vitamins, minerals, and other important nutrients that help keep our bodies healthy. Two nutrients in particular, calcium and vitamin D, are needed for strong bones.

The Role of Calcium

Calcium is needed for our heart, muscles, and nerves to function properly and for blood to clot. Inadequate calcium significantly contributes to the development of osteoporosis. Many published studies show that low calcium intake throughout life is associated with low bone mass and high fracture rates. National nutrition surveys have shown that most people are not getting the calcium they need to grow and maintain healthy bones. To find out how much calcium you need, see the Recommended Calcium Intakes chart, below.

Recommended Calcium Intakes

Age	Amount of Calcium
Infants	
Birth – 6 months	210 mg
6 months – 1 year	270 mg
Children/Young Adults	
1 – 3 years	500 mg
4 – 8 years	800 mg
9 – 18 years	1,300 mg
Adult Women & Men	
19 – 50 years	1,000 mg
50 +	1,200 mg
Pregnant or Lactating	
18 years or younger	1,300 mg
19 – 50 years	1,000 mg

Source: National Academy of Sciences, 1997.

To learn how easily you can include more calcium in your diet without adding much fat, see the Selected Calcium-Rich Foods list, below.

Selected Calcium-Rich Foods

Food Item	Serving Size	Calcium (mg)	Fat (g)	Calories
Milk				
Whole	8 oz	290	8.9	156
1% milk	8 oz	300	2.6	102
2% milk	8 oz	297	4.7	121
Skim milk	8 oz	302	0.4	86
Yogurt				
Plain fat-free (with added milk solids)	8 oz	487	0.4	136
Plain low-fat (with added milk solids)	8 oz	447	3.7	155
Fruit low-fat	8 oz	338	2.8	243
Frozen, vanilla, soft serve	½ cup	103	4.0	114
Cheese				
American cheese	1 oz	174	8.9	106
Cheddar cheese	1 oz	204	9.4	114
Cottage cheese, 1% low-fat	1 cup	138	2.3	164
Mozzarella cheese, part skim	1 oz	183	4.5	72
Muenster cheese	1 oz	203	8.5	104
Parmesan cheese, grated	1 tbsp	69	1.5	23
Ricotta cheese, part skim	½ cup	337	9.8	171
Ricotta cheese, whole milk	½ cup	257	16.1	216
Ice Cream, Vanilla				
Low-fat	½ cup	91.7	2.8	91.7
High-fat	½ cup	86.6	12	178
Fish and Shellfish				
Sardines, canned in oil, drained, including bones	3.75 oz	351	10.5	191
Salmon, pink, canned, including bones	3 oz	181	5.1	118
Shrimp, canned, drained	3 oz	50	1.7	102
Vegetables				
Bok Choy, raw (Chinese cabbage)	1 cup	74	0	9
Broccoli, cooked, drained, from raw	1 cup	71.6	0.6	23.6
Broccoli, cooked, drained, from frozen	1 cup	94	0.2	50
Soybeans, mature, boiled	1 cup	261	12	254
Collards, cooked, drained, from raw	1 cup	226	0.6	49
Turnip greens, cooked, drained, from raw (leaves and stems)	1 cup	197	0.3	29

Selected Calcium-Rich Foods

Food Item	Serving Size	Calcium (mg)	Fat (g)	Calories
Tofu	½ cup	204 *	5.6	97
Orange (navel)	1 whole	56	0.1	65
Orange Juice, fortified with calcium	8 oz	300	0.1	100
Dried figs	10	270	2.2	477
Almonds (dry roasted)	1 oz	75	15	169
Sesame seeds, kernels, toasted	1 oz	37	13.6	161
Sunflower seeds, dried	1 oz	33	14.1	162

* The calcium content of tofu may vary depending on processing methods. Tofu processed with calcium salts can have as much as 300 mg (milligrams) for every 4 oz. Often, the label or the manufacturer can provide more specific information.

Note: You may also increase the calcium in foods by following these suggestions:

1. Add nonfat powdered milk to all soups, casseroles, and drinks.
2. Buy juices, cereals, and breads that are fortified with calcium.
3. Replace whole milk and cream with skim and low-fat milk in recipes.
4. Replace sour cream with yogurt in recipes.
5. Some bottled waters contain calcium, so check the labels for more information.

Source: USDA Nutrient Data Laboratory, 2000.

Calcium Culprits

While a balanced diet aids calcium absorption, high levels of protein and sodium (salt) in the diet are thought to increase calcium excretion through the kidneys. Excessive amounts of these substances should be avoided, especially in those whose calcium intake is low.

Lactose intolerance also can lead to inadequate calcium intake. Those who are lactose intolerant have insufficient amounts of the enzyme lactase, which is needed to break down the lactose found in dairy products. In order to include dairy products in the diet, dairy foods can be taken in small quantities or treated with lactase drops, or lactase can be taken as a pill. There are even some milk products on the market that already have been treated with lactase.

Calcium Supplements

If you have trouble getting enough calcium in your diet, you may need to take a calcium supplement. The amount of calcium you will need from a supplement depends on how much calcium you obtain from food sources. There are several different calcium compounds from which to choose, such as calcium carbonate and calcium citrate, among others. Except in people with gastrointestinal disease, all major forms of calcium supplements are absorbed equally well when taken with food.

Calcium supplements are better absorbed when taken in small doses (500 mg or less) several times throughout the day. In many individuals, calcium supplements are better absorbed when taken with food. It is important to check supplement labels to ensure that the product meets United States Pharmacopeia (USP) standards.

Vitamin D

The body needs vitamin D to absorb calcium. Without enough vitamin D, we can't form enough of the hormone calcitriol (known as the "active vitamin D"). This in turn leads to insufficient calcium absorption from the diet. In this situation, the body must take calcium from its stores in the skeleton, which weakens existing bone and prevents the formation of strong, new bone.

You can get vitamin D in three ways: through the skin, from the diet, and from supplements. Vitamin D is formed naturally by the body after exposure to sunlight. Fifteen minutes in the sun a few times a week without sunscreen is plenty for many people to manufacture and store all of the vitamin D they need. Experts recommend a daily intake of between 400 and 800 International Units (IU) of vitamin D, which also can be obtained from supplements or vitamin D-rich foods such as egg yolks, saltwater fish, liver, and fortified milk. The Institute of Medicine recommends no more than 2,000 IU per day. However, sometimes doctors prescribe higher doses for people who are deficient in vitamin D.

A Complete Osteoporosis Program

Remember, a balanced diet rich in calcium and vitamin D is only one part of an osteoporosis prevention or treatment program. Like exercise, getting enough calcium is a strategy that helps strengthen bones at any age. But these strategies may not be enough to stop bone loss caused by lifestyle, medications, or menopause. It is important to speak to your doctor to determine the need for an osteoporosis medication in addition to diet and exercise.

The National Resource Center acknowledges the assistance of the National Osteoporosis Foundation in the preparation of this publication.

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For Your Information

For updates and for any questions about any medications you are taking, please contact the U.S. Food and Drug Administration at 1-888-INFO-FDA (1-888-463-6332, a toll-free call) or visit their Web site at www.fda.gov.

Exercise for Your Bone Health

Vital at every age for healthy bones, exercise is important for treating and preventing osteoporosis. Not only does exercise improve your bone health, it also increases muscle strength, coordination, and balance, and leads to better overall health.

Why Exercise?

Like muscle, bone is living tissue that responds to exercise by becoming stronger. Young women and men who exercise regularly generally achieve greater peak bone mass (maximum bone density and strength) than those who do not. For most people, bone mass peaks during the third decade of life. After that time, we can begin to lose bone. Women and men older than age 20 can help prevent bone loss with regular exercise. Exercising allows us to maintain muscle strength, coordination, and balance, which in turn help to prevent falls and related fractures. This is especially important for older adults and people who have been diagnosed with osteoporosis.

The Best Bone Building Exercise

The best exercise for your bones is the weight-bearing kind, which forces you to work against gravity. Some examples of weight-bearing exercises include lifting weights, walking, hiking, jogging, climbing stairs, tennis, and dancing. Examples of exercises that are not weight-bearing include swimming and bicycling. While these activities help build and maintain strong muscles and have excellent cardiovascular benefits, they are not the best way to exercise your bones.

Exercise Tips

If you have health problems – such as heart trouble, high blood pressure, diabetes, or obesity – or if you are over age 40, check with your doctor before you begin a regular exercise program.

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The National Institutes of Health (NIH) is a component of the U.S. Department of Health and Human Services.

According to the Surgeon General, the optimal goal is at least 30 minutes of physical activity on most days, preferably daily.

Listen to your body. When starting an exercise routine, you may have some muscle soreness and discomfort at the beginning, but this should not be painful or last more than 48 hours. If it does, you may be working too hard and need to ease up. STOP exercising if you have any chest pain or discomfort, and see your doctor before your next exercise session.

If you have osteoporosis, ask your doctor which activities are safe for you. If you have low bone mass, experts recommend that you protect your spine by avoiding exercises or activities that flex, bend, or twist it. Furthermore, you should avoid high-impact exercise in order to lower the risk of breaking a bone. You also might want to consult with an exercise specialist to learn the proper progression of activity, how to stretch and strengthen muscles safely, and how to correct poor posture habits. An exercise specialist should have a degree in exercise physiology, physical education, physical therapy, or a similar specialty. Be sure to ask if he or she is familiar with the special needs of people with osteoporosis.

A Complete Osteoporosis Program

Remember, exercise is only one part of an osteoporosis prevention or treatment program. Like a diet rich in calcium and vitamin D, exercise helps strengthen bones at any age. But proper exercise and diet may not be enough to stop bone loss caused by medical conditions, menopause, or lifestyle choices such as tobacco use and excessive alcohol consumption. It is important to speak with your doctor about your bone health. Discuss when you might be a candidate for a bone mineral density test. If you are diagnosed with low bone mass, ask what medications might help keep your bones strong.

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For Your Information

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Medications to Prevent and Treat Osteoporosis

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The National Institutes of Health (NIH) is a component of the U.S. Department of Health and Human Services.

Although there is no cure for osteoporosis, several medications approved by the U.S. Food and Drug Administration (FDA) can help stop or slow bone loss, or help form new bone, and reduce the risk of fractures. Currently, alendronate, raloxifene, risedronate, and ibandronate are approved for preventing and treating postmenopausal osteoporosis. Teriparatide is approved for treating the disease in postmenopausal women and men at high risk for fracture. Estrogen/hormone therapy (ET/HT) is approved for preventing postmenopausal osteoporosis, and calcitonin is approved for treatment. In addition, alendronate is approved for treating osteoporosis in men, and both alendronate and risedronate are approved for use by men and women with glucocorticoid-induced osteoporosis. Alendronate plus vitamin D is approved for the treatment of osteoporosis in postmenopausal women and in men. Risedronate with calcium is approved for the prevention and treatment of osteoporosis in postmenopausal women.

Bisphosphonates

Alendronate (Fosamax[1]), risedronate (Actonel), and ibandronate (Boniva) are medications from the class of drugs called bisphosphonates. Like estrogen and raloxifene, these bisphosphonates are approved for both prevention and treatment of postmenopausal osteoporosis. Alendronate is

[1] Brand names included in this publication are provided as examples only, and their inclusion does not mean that these products are endorsed by the National Institutes of Health or any other Government agency. Also, if a particular brand name is not mentioned, this does not mean or imply that the product is unsatisfactory.

also approved to treat bone loss that results from glucocorticoid medications like prednisone or cortisone and is approved for treating osteoporosis in men. Risedronate is also approved to prevent and treat glucocorticoid-induced osteoporosis. Alendronate plus vitamin D is approved for the treatment of osteoporosis in postmenopausal women and in men. Risedronate with calcium is approved for the prevention and treatment of osteoporosis in postmenopausal women.

Alendronate and risedronate have been shown to increase bone mass and reduce the incidence of spine, hip, and other fractures. Ibandronate has been shown to reduce the incidence of spine fractures.

Alendronate is available in daily and weekly doses, while alendronate plus vitamin D is available in a weekly dose. Risedronate is available in daily and weekly doses, while risedronate with calcium is available in a weekly dose with daily calcium. Ibandronate is available in a monthly dose and as an intravenous injection administered once every three months.

Oral bisphosphonates should be taken on an empty stomach and with a full glass of water first thing in the morning. It is important to remain in an upright position and refrain from eating or drinking for at least 30 minutes after taking a bisphosphonate.

Side effects for bisphosphonates include gastrointestinal problems such as difficulty swallowing, inflammation of the esophagus, and gastric ulcer. There have been rare reports of osteonecrosis of the jaw and of visual disturbances in people taking bisphosphonates.

Raloxifene

Raloxifene (Evista) is approved for the prevention and treatment of postmenopausal osteoporosis. It is from a class of drugs called Selective Estrogen Receptor Modulators (SERMs) that appear to prevent bone loss in the spine, hip, and total body. Raloxifene has beneficial effects on bone mass and bone turnover and can reduce the risk of vertebral fractures. While side effects are not common with raloxifene, those reported include hot flashes and blood clots in the veins, the latter of which is also associated with estrogen therapy. Additional research studies on raloxifene will continue for several more years.

Calcitonin

Calcitonin is a naturally occurring hormone involved in calcium regulation and bone metabolism. In women who are at least 5 years past menopause, calcitonin slows bone loss, increases spinal bone density, and according to anecdotal reports, relieves the pain associated with bone fractures. Calcitonin reduces the risk of spinal fractures and may reduce hip fracture risk as well. Studies on fracture reduction are ongoing. Calcitonin is currently available as an injection or nasal spray. While it does not affect other organs or systems in the body, injectable calcitonin may cause an allergic reaction and unpleasant side effects including flushing of the face and hands, frequent urination, nausea, and skin rash. The only side effect reported with nasal calcitonin is a runny nose.

Teriparatide

Teriparatide (Forteo) is an injectable form of human parathyroid hormone. It is approved for postmenopausal women and men with osteoporosis who are at high risk for having a fracture. Teriparatide stimulates new bone formation in both the spine and the hip. It also reduces the risk of vertebral and nonvertebral fractures in postmenopausal women. In men, teriparatide reduces the risk of vertebral fractures. However, it is not known whether teriparatide reduces the risk of nonvertebral fractures. Side effects include nausea, dizziness, and leg cramps. Teriparatide is approved for use for up to 24 months.

Estrogen/Hormone Therapy

Estrogen/hormone therapy (ET/HT) has been shown to reduce bone loss, increase bone density in both the spine and hip, and reduce the risk of hip and spine fractures in postmenopausal women. ET/HT is approved for preventing postmenopausal osteoporosis and is most commonly administered in the form of a pill or skin patch. When estrogen – also known as estrogen therapy or ET – is taken alone, it can increase a woman's risk of developing cancer of the uterine lining (endometrial cancer). To eliminate this risk, physicians prescribe the hormone progestin – also known as hormone therapy or HT – in combination with estrogen for those women who have not had a hysterectomy. Side effects of ET/HT include vaginal bleeding, breast tenderness, mood disturbances, blood clots in the veins, and gallbladder disease.

The Women's Health Initiative (WHI), a large Government-funded research study, recently demonstrated that the drug Prempro, which is used in hormone therapy, is associated with a modest increase in the risk of breast cancer, stroke, and heart attack. The WHI also demonstrated that estrogen therapy is associated with an

increase in the risk of stroke. It is unclear whether estrogen therapy is associated with an increased risk of breast cancer or cardiovascular events. A large study from the National Cancer Institute indicated that long-term use of estrogen therapy may be associated with an increased risk of ovarian cancer. It is unclear whether hormone therapy carries a similar risk.

Any estrogen therapy should be prescribed for the shortest period of time possible. When used solely for the prevention of postmenopausal osteoporosis, any ET/HT regimen should only be considered for women at significant risk of osteoporosis, and nonestrogen medications should be carefully considered first.

Revised May 2006

For Your Information

This publication contains information about medications used to treat the health condition discussed here. When this fact sheet was printed, we included the most up-to-date (accurate) information available. Occasionally, new information on medication is released.

For updates and for any questions about any medications you are taking, please contact the U.S. Food and Drug Administration at 1-888-INFO-FDA (1-888-463-6332, a toll-free call) or visit their Web site at www.fda.gov.

Medications for Osteoporosis Prevention and Treatment

Therapy Option	Types	Brand Names	FDA Approval	Forms of Administration	Other Considerations	Possible Side Effects
Bisphosphonates	alendronate risedronate ibandronate alendronate plus vitamin D risedronate with calcium	Fosamax[1] Actonel Boniva Fosamax Plus D Actonel with Calcium	Fosamax, Actonel, and Boniva approved for preventing and treating osteoporosis in postmenopausal women. Fosamax approved for treating glucocorticoid-induced osteoporosis and for osteoporosis in men. Actonel approved for preventing and treating glucocorticoid-induced osteoporosis. Fosamax Plus D approved for treating osteoporosis in postmenopausal women and in men. Actonel with Calcium approved for the prevention and treatment of osteoporosis in postmenopausal women.	Fosamax and Actonel available as pill in daily and weekly doses. Boniva available as pill in monthly dose and as an intravenous injection administered once every 3 months. Fosamax Plus D and Actonel with Calcium available in weekly dose.	Oral medication should be taken on an empty stomach with a full glass of water first thing in the morning. After taking the medication, remain in an upright position and do not eat or drink for at least 30 minutes.	May include abdominal or musculoskeletal pain, nausea, heartburn, irritation of the esophagus, and rarely osteonecrosis of the jaw.
Selective Estrogen Receptor Modulators (SERMs)	raloxifene	Evista	Approved for preventing and treating osteoporosis in postmenopausal women	Pill in daily dose	May have a protective effect against breast cancer	May include hot flashes and blood clots in the veins
Calcitonin	salmon calcitonin	Miacalcin	Approved for treating osteoporosis in postmenopausal women	Daily nasal spray or injection	Approved for use in women at least 5 years beyond menopause	Use of nasal spray may result in runny, irritated nose. Injectable form may cause flushing of the face and hands, frequent urination, nausea, and skin rash.

Therapy Option	Types	Brand Names	FDA Approval	Forms of Administration	Other Considerations	Possible Side Effects
Parathyroid Hormone	teriparatide	Forteo	Approved for treating osteoporosis in postmenopausal women and men at high risk for fracture	Daily injection	Approved for use for up to 24 months	May include nausea, dizziness, and cramps
Estrogen/ Hormone Therapy (ET/HT)	estrogen therapy	Including: Climara Estrace Estraderm Estratab Ogen Ortho-Est Premarin Vivelle	Approved for preventing osteoporosis in postmenopausal women	Pill and skin patch forms	Estrogen taken without progesterone increases the risk of uterine cancer. ET/HT should be considered only for women at significant risk of postmenopausal osteoporosis and only after nonestrogen medications have been considered.	May increase risk of blood clots in the veins, stroke, heart attack, and breast and ovarian cancer. Also, vaginal bleeding, breast tenderness, mood disturbances, and gallbladder disease.
	hormone therapy	Including: Activella Femhrt Ortho-Prefest Premphase Prempro				

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General Information on Bone Health and Osteoporosis			
Title of Publication	✓	**Title of Publication**	✓
Osteoporosis Overview (R106)		Medications to Prevent and Treat Osteoporosis (R107)	
Bone Mass Measurement: What the Numbers Mean (R209)		Osteoporosis: The Diagnosis (R203)	
Calcium Supplements: What to Look for (R208)		Topics in Osteoporosis: Exercise and Bone Health (R707)	
Calcium and Vitamin D: Important at Every Age (R301)		Topics in Osteoporosis: Nutrition and the Skeleton. The Role of Calcium and Other Nutrients (R708)	
Exercise for Your Bone Health (R303)		What is Bone? (R304)	
For People With Osteoporosis: How to Find a Doctor (R201)			

Special Topics on Bone Health and Osteoporosis			
Title of Publication	✓	**Title of Publication**	✓
Fitness and Bone Health for Women: The Skeletal Risk of Overtraining (R614)		Phytoestrogens and Bone Health (R618)	
Juvenile Osteoporosis (R609)		Pregnancy, Breastfeeding, and Bone Health (R703)	
Once is Enough: A Guide to Preventing Future Fractures (R616)		Preventing Falls and Related Fractures (R613)	
Oral Health and Bone Disease (R704)		Smoking and Bone Health (R705)	
Osteoporosis: Coping with Chronic Pain (R202)		Vitamin A and Bone Health (R617)	
Osteoporosis: Peak Bone Mass in Women (R701)			

Information for Specific Populations			
Title of Publication	✓	**Title of Publication**	✓
Kids and Their Bones: A Guide for Parents (NIH02-5186)		Osteoporosis and Hispanic Women (R602)	
Osteoporosis and African American Women (R607)		Osteoporosis in Men (R615)	
Osteoporosis and Asian American Women (R601)			

Secondary Osteoporosis			
Title of Publication	✓	**Title of Publication**	✓
Bed Rest and Immobilization: Risk Factors for Bone Loss (R608)		What People With Diabetes Need to Know About Osteoporosis (R806)	
Osteoporosis and Arthritis: Two Common But Different Conditions (R611)		What People With Inflammatory Bowel Disease Need to Know About Osteoporosis (R809)	
What Breast Cancer Survivors Need to Know About Osteoporosis (R805)		What People With Lactose Intolerance Need to Know About Osteoporosis (R807)	
What People Recovering from Alcoholism Need to Know About Osteoporosis (R804)		What People With Lupus Need to Know About Osteoporosis (R801)	
What People With Anorexia Nervosa Need to Know About Osteoporosis (R803)		What People With Osteogenesis Imperfecta Need to Know About Osteoporosis (I125)	
What People With Asthma Need to Know About Osteoporosis (R810)		What People With Rheumatoid Arthritis Need to Know About Osteoporosis (R802)	
What People With Celiac Disease Need to Know About Osteoporosis (R808)			

Large Print Materials			
Title of Publication	✓	**Title of Publication**	✓
Calcium and Vitamin D (R301L)		For People With Osteoporosis: How to Find a Doctor (R201L)	
Exercise for Your Bone Health (R303L)		Preventing Falls and Related Fractures (R613L)	

Información en Lengua Española/ Information on Bone Health and Osteoporosis in Spanish			
Título de la Publicación/ **Title of Publication**	✓	**Título de la Publicación/** **Title of Publication**	✓
Los niños y sus huesos: una guía para los padres (Kids and Their Bones: A Guide for Parents) (NIH03-5186S)		Huesos sanos para los adolecentes (Bone Basics for Teens) (R402S)	
El calcio y la vitamina D: Importantes a toda edad (Calcium & Vitamin D: Important at Every Age) (R301S)		Los huesos de las mujeres de edad madura (Bone Basics for Midlife Women) (R404S)	
Haga ejercicios para tener huesos saludables (Exercise for Your Bone Health) (R303S)		Huesos sanos para los hombres y mujeres de edad avanzada (Bone Basics for Older Men and Women) (R405S)	
Medidas de la densidad óseas: El significado de los números (Bone Mass Measurement: What the Numbers Mean) (R209S)		Los huesos de los hombres de todas las edades (Bone Basics for Men of All Ages) (R406S)	
Las caídas y las fracturas asociadas: el riesgo de no diagnosticar osteoporosis (Falls & Related Fractures: The Risk of Undiagnosed Osteoporosis) (R613S)		La osteoporosis y la artritis: Dos afecciones comunes pero distintas (Osteoporosis and Arthritis: Two Common but Different Conditions) (R611S)	

Information on Bone Health and Osteoporosis in Asian Languages			
Title of Publication	✓	**Title of Publication**	✓
Bone Health and Osteoporosis: A Guide for Asian Women Aged 50 and Older		Bone Health and Osteoporosis: A Guide for Asian Women Aged 50 and Older	
Cambodian (R901KH)		Lao (R901LA)	
Chinese (R901C)		Vietnamese (R901V)	
Korean (R901K)		English (R901)	

Related Bone Diseases Fact Sheets			
Title of Publication	✓	**Title of Publication**	✓
Osteogenesis Imperfecta Overview (I101)		Information for Patients about Paget's Disease of Bone (P110)	
Information for Patients About Fibrous Dysplasia (P111)		Information for Patients About Primary Hyperparathyroidism (P112)	
Information for Patients About Osteopetrosis (P117)			

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